Q. IF UNBUNDLED ELEMENTS WERE PRICED BELOW COST, WOULD THIS CREATE AN ECONOMIC DISINCENTIVE FOR FACILITIES-BASED COMPETITION?

A. Yes, because U S WEST and other companies will have much less incentive to invest in the network, reducing facilities-based competition and undermining the intent of the Act to stimulate investment in our nation's infrastructure. If investment in the network is reduced, advanced communications services will go undeveloped, and the very network needed to provide interconnection, call termination, unbundled elements and wholesale services will wither. As explained in the resale section below, setting too large of an avoided cost retail discount would have a similar effect.

Q. WHAT DOES THE FCC ORDER HAVE TO SAY ABOUT GEOGRAPHICALLY DEAVERAGING PRICES FOR UNBUNDLED NETWORK ELEMENTS AND INTERCONNECTION SERVICES?

A. The FCC Order requires incumbent LECs to deaverage prices on unbundled network elements and interconnection services.

> The 1996 Act mandates that rates for interconnection and unbundled elements be "based on the cost . . . of providing the interconnection of network elements." We agree with most parties that deaveraged rates more closely reflect the actual costs of providing interconnection and unbundled elements. Thus, we conclude that rates for interconnection and unbundled elements must be geographically deaveraged.[51]

[51] FCC Order, paragraph 764.

Q. ARE THERE ANY ECONOMICALLY HARMFUL EFFECTS OF DEAVERAGING THE PRICE OF UNBUNDLED NETWORK ELEMENTS WHEN RETAIL RATES REMAIN GEOGRAPHICALLY AVERAGED?

A. Yes. I support the proposition that U S WEST should be allowed to geographically deaverage <u>both</u> its retail and wholesale rates so they reflect the cost of providing service. This will reduce opportunities for competitors to cherry pick, targeting the lowest cost, highest margin customers in dense urban areas. However, if only wholesale rates (of unbundled network elements sold to competitors) are deaveraged while U S WEST's retail rates remain geographically averaged, the problems associated with cherry picking will be exacerbated. For example, new entrants will be able to buy loops from U S WEST for high density urban business customers at low cost deaveraged rates while U S WEST will be forced to sell those same loops to the same customers (as part of local exchange service) at above cost, geographically averaged rates. This will lead to a situation where U S WEST loses market share most rapidly in the highest density urban markets. If its rates are not rebalanced, U S WEST will be forced into severe financial distress because it will be left serving only higher cost low revenue customers with no source of cross-subsidy as formerly provided by low cost high volume urban customers.

C. GENERAL DEFICIENCIES IN THE HATFIELD MODEL AS A TELRIC ESTIMATE

Q. DO YOU EXPECT AT&T AND MCI TO SUBMIT THE HATFIELD MODEL IN THIS PROCEEDING?

A. Yes, I do expect they will submit the Hatfield Model and claim that it's results are reasonable estimates of TELRIC. In anticipation, I am providing a criticism of the Hatfield Model.

Q. WOULD YOU PLEASE DESCRIBE THE ESSENTIAL ELEMENTS OF A COST MODEL?

A. A cost model has three essential elements. First of all there is input data which is related to the cost to be estimated. Second, there is an algorithm, usually a mathematical equation, which relates the input data to the cost estimate. Lastly there are user supplied parameters which adapt the algorithm to fit the specific circumstances for which the cost is to be estimated.

The following model for estimation of the fuel cost of a road trip illustrates each of the elements of a cost model:

$$\text{Fuel Cost} = \frac{\text{Length of Trip}}{\text{Miles / Gallon}} \text{ X Price of Fuel}$$

In this example the length of trip and price of fuel are data inputs, the user supplied parameter is the mileage of the vehicle to be used and the algorithm is the equation relating cost to the two data inputs and the user supplied parameter.

Q. COULD THE COST BE ESTIMATED EVEN IF ONE OR MORE OF THE INPUT DATA WERE NOT AVAILABLE?

A. Yes, in the above example it might be difficult to obtain the price of fuel at all points along the route. As a proxy for the actual average price of fuel at each point along the route, the local price might be used. The road distance might also be difficult to obtain, in which case the straight line distance could be used as a proxy. The accuracy of the model can depend heavily on the choice of proxy used. Use of straight line distance in place of actual road distance could easily be used where topography was unobstructed and roads were laid out in a consistent north-south, east-west grid pattern. Where the topography is obstructed by mountains, lakes or other restrictions, its use would cause serious errors in the estimated cost.

Q. IS THERE MORE THAN ONE WAY BY WHICH A COST MODEL CAN YIELD FLAWED ESTIMATES?

A. For this discussion it is useful to identify three ways a model can be flawed. First, the user supplied parameters to the model may not reflect the conditions under which the model is to be applied. Second, a model might use a proxy input which was not carefully chosen and whose relationship to cost is not consistent and known. Lastly, the algorithm or equations used to relate the estimated cost to the input data and user supplied parameters may not properly represent the underlying process to be estimated.

Q. COULD YOU ILLUSTRATE HOW ERRORS OF THESE TYPES MIGHT OCCUR?

A. Assume that you are planning a trip by automobile and want to estimate the cost of fuel for the trip. Using the simple cost model described above, the estimated cost will be based on the length of the trip, the local price of gasoline and the mileage of your automobile. The relationship can be stated as:

$$\text{Cost} = \frac{\text{Length of Trip}}{\text{Miles / Gallon}} \text{ X Local Price of Gasoline}$$

Assume that you know the actual route length but are using the local price of gasoline as a proxy for the actual price of gasoline that will be purchased throughout the trip. The first kind of error would occur if I were to use a mileage parameter appropriate for highway driving to estimate the cost of a trip through a congested city.

An error of the second type would result if the local price of gasoline, which is a proxy for the average price along the route, was substantially lower or higher than the those prices.

To see how an error of the third type can occur consider the following modification of the fuel cost model.

$$\text{Cost} = \frac{(\text{Length of trip})^2}{700 \text{ X } (\text{Miles / Gallon})} \text{ X Local Price of Gasoline}$$

This modified version is clearly wrong and for a trip length of 1,500 miles will result in an estimated cost more than twice the actual. However, even such a grossly mis-specified model will provide estimates within 15% of the correct estimate for trips of lengths between 600 and 800 miles.

Q. ARE ALL OF THESE TYPES OF ERRORS UNDER THE CONTROL OF THE MODEL DEVELOPER?

A. It should be very clear that the first type of error, the use of an inappropriate user supplied parameter, is not a flaw in the model, it is a flaw in the **use** of the model. However, to the extent that the model developers supply default values which they purport to be appropriate for a specific circumstances, they do bear some responsibility for these errors. The second and third types of errors, inappropriate input data (hard wired into the model) and improper representation of the underlying process, are under the sole control of the model developers. If either of these types of errors are present, no amount of adjustment of user supplied parameters will provide consistent estimates of cost.

Q. DOES THE FACT THAT A MODEL PRODUCES REASONABLE ESTIMATES UNDER ONE SET OF CIRCUMSTANCES VALIDATE THE MODEL?

A. Certainly not. As I demonstrated above, even a model with a seriously flawed algorithm will produce reasonable results over some range of circumstances.

Q. DOES THE HATFIELD MODEL EXHIBIT ANY OF THE TYPES OF ERRORS YOU HAVE DESCRIBED?

A. Yes, the generic Hatfield Model exhibits both the second and third type of problem, particularly in the calculation of the amount of distribution plant required. In addition, the user defined inputs used with Hatfield Model as submitted by AT&T and MCI in the Colorado Arbitration proceeding were an example of the first type of error – the inputs failed to accurately reflect the real world conditions under which the model was to be applied. Sections VI.E and VI.F below show that if some of these unrealistic inputs are modified, the Hatfield Model provides more reasonable cost estimates.

Q. WOULD YOU PLEASE DESCRIBE HOW THE HATFIELD MODEL ESTIMATES THE LENGTH OF DISTRIBUTION CABLE AND WHETHER THAT METHOD IS APPROPRIATE?

A. The Hatfield model assumes that the total length of distribution cable required to serve a specific Census Block Group (CBG) is determined by the density of households and the area, A, of the Census Block. Specifically, $L = n \text{ X } \sqrt{A}$, where n is a number between two and six determined by the density of the CBG. To see why this formula is an inappropriate representation, suppose the CBG is split into two Census Blocks instead of one. The amount of cable provided to serve those same households is now $2 \text{ X } n \text{ X } \sqrt{A/2}$. The estimated length has **increased** by a factor of $2/\sqrt{2}$ or 1.41 simply by arbitrarily dividing the single CBG into two. Since the model can provide very different lengths of distribution cable for the same area and set of households, the equation used does not consistently represent the underlying process. Also, the CBG area is arguably a questionable proxy input for the distribution length. It would be a valid proxy only if the Bureau of the Census delineated Census Blocks in a very specific and consistent way throughout the country, and the Hatfield Model was able to calibrate its different density zones according to these census block area sizes. Figure 1 below shows that the opposite is true. In Colorado there is a tremendous variation in census block areas, even within the six density zones specified by the Hatfield Model.

Figure 1

CENSUS BLOCK SIZES IN COLORADO EXHIBIT SUBSTANTIAL VARIATION

Hatfield Density Ranges (Lines per SQ MI)	Mean Census Block Area (SQ MI)	Standard Deviation	Standard Deviation as a % of Mean
1. (0-5)	190.90	207.30	109
2. (5-200)	13.78	17.70	128
3. (200-650)	1.05	0.80	76
4. (650-850)	0.62	0.41	66
5. (850-2550)	0.26	0.18	69
6. (>2550)	.13	0.08	62

Source: Hatfield Model 2.2.2 BCM-Plus Input Data File

Q. HAVE YOU IDENTIFIED ANY OTHER SPECIFIC PROBLEMS WITH THE HATFIELD MODEL?

A. Extensive investigation by my staff has uncovered several features of the Hatfield Model which are very discomforting. In particular we have found that the model provides for several user supplied parameters which definitely should affect the estimated cost of outputs but which are in fact never used in any calculation and therefore have no effect on the final output.[52] Only very careful scrutiny of the model uncovered these spurious "inputs." Anyone taking the model at face value would be misled into believing that changing those inputs would actually change the output of the model. It would seem that conscientious developers, interested in the making his work as transparent as possible to users, would identify any "inputs" which were not used in the calculation.

Q. WOULD YOU PLEASE COMMENT ON THE ISSUE OF COST MODEL VALIDATION?

A. Amid discussions about the details of model algorithms, inputs, and assumptions, it is easy to forget that the key test for any cost model is its ability to represent reality. It is important to examine the workings of each cost model to ascertain that: 1) equations are performing tasks correctly; 2) inputs are verifiable; and 3) assumptions are reasonable and internally consistent with other assumptions. The final test of a cost model, however, is whether or not it produces reasonable results. If it does not, then its results are of little or no use and should be discarded, since they can be misleading and dangerous. A model is a set of instructions, much like a recipe, and after the instructions are followed and the food comes out of the oven, it either looks, smells, and tastes like something edible, or it

[52] Specifically the user supplied parameters labeled *Carrier-carrier customer service per line per year:, Operating state and local income tax factor:* and *Central Office Switching Expense Factor:,* are never used in any calculations and hence have no affect on the output of the model.

does not. If it does not, then it is not, and no explanations of how easy the recipe is to read, or how accessible the ingredients are, can change that fact. There is truth in the old adage that the "proof is in the pudding."

Q. CAN YOU EXPLAIN WHAT THE FUNDAMENTAL FLAW IN THE HATFIELD MODEL IS?

A. In this portion of my testimony I will provide detailed criticism of the Hatfield model and comparisons to U S WEST's loop cost model. When default values are loaded into LECG's copy of the Hatfield Model, the model estimates that the average amount of investment per loop in Colorado is $578. This is approximately 65 percent of the historic investment per loop as cited in the direct testimony of U S WEST witness Garrett Y. Fleming and less than one-half of investment cited earlier this year by AT&T in a proceeding before the FCC; it is approximately 60 percent of U S WEST's estimate of the TELRIC investment and less than 40 percent of last year's construction company-wide investment per line added for U S WEST. In short, the estimate of $578 per loop is not reasonable. When the results of a construction model vary so dramatically from experience, either the model has uncovered some fundamental ability to increase efficiency, or the model is wrong and in serious need of repair. After close examination of the model by my staff under my direction, it is clear that this model has not uncovered any fundamental ability to increase the efficiency of installing loops. Rather, the model uses incorrect assumptions and understated inputs to produce unreasonable results. This is the fundamental flaw in the model.

Q. DO ANALYSTS OF THE HATFIELD MODEL SHARE YOUR POSITION THAT THIS MODEL PRODUCES UNREASONABLE RESULTS?

A. Yes. Joel Shifman, of the Maine Public Utility Commission, and Ron Choura, from the Michigan Public Service Commission state that:

> [m]ost importantly the results of the Hatfield model do not even pass a 'straight face test'...the results of the Hatfield model do not even come close to correlating to the order of magnitude of net book costs...the lowest and highest cost jurisdictions under the Hatfield model, which are California and Mississippi respectively, are far from the lowest and highest cost jurisdictions based on actual loop cost data that is available publicly.[53]

Shifman and Choura also criticize the structure of the Hatfield model across a number of dimensions, including fill factors that are too high, depreciation rates that are too low, a faulty distribution plan, unrealistic switch prices and cable costs, long copper drops with no conditioning, amplification, or loading costs, and "a mathematical construct to determine customer locations without demonstrating that the resulting locations in any way match reality."[54] Their assessment of model updates is that "[i]t would appear that the revisions to the Hatfield model are result driven and the model can be adjusted to produce whatever answer its sponsors desire."[55]

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[53] Shifman, Joel and Ron Choura, "Universal Service Existing Proxy Models: What can they be used for?" submitted to the Biannual Regulatory Information Conference (BRIC), September 1996, pp. 24-25.

[54] Shifman, Joel and Ron Choura, "Universal Service Existing Proxy Models: What can they be used for?" submitted to the Biannual Regulatory Information Conference (BRIC), September 1996, pp. 23-24.

[55] Shifman, Joel and Ron Choura, "Universal Service Existing Proxy Models: What can they be used for?" submitted to the Biannual Regulatory Information Conference (BRIC), September 1996, pp. 24.

Q. WAS THE HATFIELD MODEL CRITICIZED BY THE CALIFORNIA PUBLIC UTILTIY COMMISSION IN THE RECENT UNIVERSAL SERVICE PROCEEDING?

A. Yes. The California PUC did not accept the Hatfield Proxy Model (HPM) as an appropriate estimator of the cost of providing local exchange service for the purpose of establishing a state universal service scheme. According to the CPUC:

> While the HPM's extensions to the BCM are open and flexible, the underlying inputs and assumptions in the BCM are not...Certain critical assumptions and inputs cannot be changed by the user because: (1) they are locked; and (2) changes are restricted by copyright.[56]
>
> There are three classes of difficulties [in verifying a model's inputs and assumptions] with the HPM: (1) it relies on assumptions in the BCM which AT&T/MCI cannot alter or explain; (2) it relies on unnamed experts; and (3) it relies on selected portions of the cost studies from other jurisdictions.[57]

Q. PROPONENTS OF THE HATFIELD MODEL CLAIM THAT ONE OF ITS STRENGTHS IS THAT IT IS BASED ON PUBLICLY AVAILABLE DATA. DO YOU AGREE?

A I have two comments on this point. First, many of the fundamental assumptions and prices in the Hatfield model are based on opinions of a single individual who professes to be a subject matter expert. Clearly the opinions of a single person do not constitute publicly available sources. As noted by Mr. Mercer in a recent deposition, many of the

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[56] California Public Utilities Commission, "Rulemaking on the Commission's Own Motion into Universal Service." Decision 96-10-066, October 25, 1996, pg. 119.

[57] California Public Utilities Commission, "Rulemaking on the Commission's Own Motion into Universal Service." Decision 96-10-066, October 25, 1996, pg. 122.

inputs for the Hatfield model are from Mr. John Donovan.[58] Second, the use of publicly available data by the Hatfield model is not necessarily a strength. My experience with quantitative information in the telecommunications industry is that company-supplied data is almost always more accurate than publicly available data. LEC's models use publicly available data when it is necessary to protect proprietary information in public filings or when company data are not available.

Q. DOES THE HATFIELD MODEL FOLLOW THE ECONOMIC COSTING METHODOLOGIES YOU OUTLINE ABOVE?

A. No, it does not. I explain below how it violates the methodologies I outlined earlier in Sections VI.A and VI.B. However, many of these violations can be corrected by modifying the inputs and assumptions of the model.

[58] See "Video Deposition of Robert A. Mercer," Before the Colorado Public Utilities Commission, September 19, 1996.

D. HATFIELD AND RLCAP INVESTMENT ESTIMATES

Q. WHEN INCORRECT ASSUMPTIONS IN THE HATFIELD MODEL ARE CHANGED TO REASONABLE VALUES, DOES THIS MODEL PROVIDE AN ESTIMATE OF THE AVERAGE LOOP INVESTMENT IN COLORADO THAT IS SIMILAR TO U S WEST'S RLCAP MODEL?

A. Yes. As demonstrated below in Figure 2, when the Hatfield model is run with default values for all variables, the total investment per line is $578, which is 64 percent of the estimate from RLCAP. When we correct the default assumption in the Hatfield model that a telecommunications provider will only bear one-third of the cost of placing structure (poles, conduits, and trenching),[59] to 50 percent for aerial, 100 percent for underground, and 82 percent for buried to account for a reasonable amount of facilities sharing such as developer supplied trenching, the Hatfield investment estimate increases by over 40 percent to $828 per line. If, in addition, U S WEST values are used for drop and NID investment, the Hatfield investment estimate is $883. Finally, if we add the $133 of average investment per unbundled loop, U S WEST's best estimate of investment costs necessary for providing unbundled loops when pair gain technology is being used, the Hatfield estimate becomes $1016. With these three reasonable modifications, the investment estimate from the Hatfield model is in line with a range of real world estimates and is actually thirteen percent higher than the estimate from RLCAP. With additional changes, such as more reasonable fill factors and trenching costs, the Hatfield model would produce an average investment level that exceeds RLCAP estimates in Colorado by an even greater amount.

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[59] The Hatfield Model thus assumes that other utilities such as gas, electricity, cable and other telecommunications carriers will pay for 66 percent of the costs of installing structure. Hatfield Model, Version 2.2, Release 2, Appendix C, Convergence Module Inputs, September 4, 1996.

Figure 2

COMPARISON OF INVESTMENT OUTPUT IN COLORADO FROM RLCAP AND HATFIELD

	Investment Per Loop	% of RLCAP TELRIC	Monthly Loop Cost	% of Monthly RLCAP Loop Cost
Hatfield With Defaults	$578	64%	$16.13	62%
Hatfield With U S WEST Structure Ratio	$829	92%	$20.33	78%
Hatfield With U S WEST Structure Ratio and Drop Investment	$875	97%	$21.37	82%
Hatfield With U S WEST Structure Ratio, Drop Investment, and Additional Unbundling Costs	$1008	112%	$23.40	90%
RLCAP TELRIC	$901	100%	$25.97	100%

Q. IS IT YOUR VIEW THAT THESE THREE DIFFERENCES ARE THE ONLY SUBSTANTIAL DIFFERENCES BETWEEN HATFIELD AND RLCAP IN TERMS OF THE INVESTMENT PER LINE?

A. No. There are other substantial differences between the investment portions of the Hatfield and RLCAP models, including, as I mentioned before, fill factors and trenching costs, but we would not be discussing the investment portions of these models at such length if it were not for the significant difference in their original loop investment estimates. By correcting these obvious flaws, the Hatfield Model produces an even higher estimate for investment per line.[60]

Q. WHAT IS WRONG WITH THE HATFIELD DEFAULT ASSUMPTION THAT THE PROVIDER OF LOOPS WILL PAY ONLY ONE-THIRD OF THE COST OF PLACING FACILITIES?

A. Based on discussions with U S WEST's cost and engineering staff, I believe that U S WEST is not able to share such a high percentage of structure costs as is assumed by the Hatfield Model. The scorched node assumption in the FCC's TELRIC principles does not extend to electric utilities and cable companies, and a local exchange provider cannot expect that the trenching, plowing, and boring schedules of these companies will coincide with its own, or that it would be able to share a substantial amount of structure with these companies.[61]

Q. HOW DOES THE HATFIELD MODEL UNDERSTATE DROP AND NID INVESTMENT COSTS?

A. The Hatfield Model assumes the drop and NID investments are $70 per household. However, based on actual deployment costs and zoning requirements, the U S WEST RLCAP model estimates, more accurately, that the drop and NID investments are an average of $154.20 per line in Colorado.

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[60] I caution that changing these few assumptions and user adjustable inputs in other states may not cause the Hatfield model to produce reasonable investment estimates as it has in Colorado.

[61] The one exception is likely to be aerial structure. Upon scorching the telephone network, there would be substantial sharing of the costs of aerial structure. This is reflected by the assumption that 50% of pole costs are shared with other utilities.

Q. DOES THE HATFIELD MODEL ACCOUNT FOR ALL THE INVESTMENT COSTS NECESSARY TO UNBUNDLE A LOCAL LOOP WHICH IS PROVISIONED USING PAIR GAIN OR DIGITAL LOOP CARRIER?

A. No. According to U S WEST cost staff, based on a preliminary analysis of the engineering design underlying the Hatfield Model, the network in the model appears to require additional investment to unbundle a loop provisioned with pair gain. The U S WEST RLCAP Model assumes all loops which are longer than 14,000 feet, or 20 percent of total loops, are provisioned with pair gain. These loops require some type of demultiplexing so they can be separated from other loops on the same feeder cable and routed to the new entrant which is purchasing the loop. Based on conversations with U S WEST's cost and engineering staff, it is my understanding that if a penetration rate of unbundled loops of around 25 percent or less is assumed, the most cost effective way to accomplish this unbundling would be to use a separate piece of electronic equipment to split out individual loops from the feeder before it hits the main distribution frame.[62]

Q. DOES THE HATFIELD MODEL USE REALISTIC ASSUMPTIONS ABOUT FIELD CONDITIONS UNDER WHICH THE RECONSTRUCTED NETWORK WOULD BE BUILT?

A. No. Hatfield 2.2.2 appears to make unrealistic assumptions about ambient field conditions under which placement of loop transmission cable structure would occur if a local telephone network were "reconstructed" in actual field conditions present today.[63]

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[62] If unbundled loops achieve more than a 25 percent market penetration (only unbundled loops served by new entrants' switches should be included in this market share calculation), the most cost effective way to unbundle pair gain loops would be to demultiplex all the loops entering the exchange. However, if all the loops in a given exchange are demultiplexed before they enter the switch, and the market share of unbundled loops falls short of the forecasted penetration rate, the LEC would left with a substantial amount of unrecovered cost.

[63] Hatfield Model, Version 2.2, Release 2, Appendix C, Convergence Module Inputs, September 4, 1996.

For example, the relationship between costs and access line density as posited by the model would be realistic only if U S WEST could install trenches and conduit for transmission cables in an undeveloped or rural environment, instead of having to tear up streets and plow through people's lawns and gardens.

Q. CAN YOU EXPLAIN IN MORE DETAIL WHY THE HATFIELD MODEL'S FILL FACTORS ARE UNREASONABLE?

A. Yes. The Hatfield model ignores the extraordinary asset-specificity of local distribution facilities by assuming unrealistically high utilization rates for loop plant.[64] Telephone switching capacity and transport facilities are relatively fungible[65] across customers and thus do not require as high an amount of stand-by capacity as do many types of loop plant. If one end user does not use a switching capacity increment, other end users can use that increment. However, the local loop and its sub-components: feeder, distribution, and drop, are not nearly as fungible, particularly segments which are dedicated to specific users or geographic areas. For example, feeder cables, which are dedicated to specific distribution areas (neighborhoods), are fungible within dedicated distribution areas but are highly asset-specific across distribution areas. Thus, if a neighborhood as a whole has higher-than-anticipated growth in demand for access lines, it may be necessary to reinforce the feeder plant by laying new feeder cables, costs which the Hatfield model ignores. Distribution plant and drops are even more asset-specific, as they are dedicated to smaller geographic areas and individual premises respectively. It is costly to redeploy distribution and drop (but less costly than laying new feeder cables). In many instances, deploying stand-by capacity in anticipation of demand for new lines (resulting in lower

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[64] Hatfield Model, Version 2.2, Release 2, September 4, 1996, p. 18.

[65] "Fungible" resources are those assets that can be quickly and easily redeployed across geography, structure type, or other dimensions to serve those customers who need them.

average fill factors) is the most cost-effective way to design and build networks. Also, state law obligations which require U S WEST to be "ready-to-serve" new or multiple line customers on a near instantaneous basis, make it necessary for U S WEST to maintain more stand-by capacity than they would for purely business reasons in a competitive market. In other words U S WEST must absorb all the upside risk that customers in any given neighborhood will demand more local exchange lines than could be reasonably anticipated. The only way to plan for this contingency is to engineer lower fill factors as a hedge against this risk. The fill factors in Hatfield 2.2.2 fail to take these realities into account.

Q. EVEN IF THE HATFIELD MODEL CORRECTLY ESTIMATED THE COST OF BUILDING A NETWORK FROM SCRATCH, WOULD THIS COST UNDERSTATE U S WEST'S COSTS OF PROVIDING LOOPS?

A. Yes. U S WEST's costs of adding capacity are higher than the Hatfield Model's cost estimates because U S WEST will not be able to construct its network from scratch (holding switching nodes constant) as is assumed by the Hatfield Model. Instead, U S WEST will be providing some elements with existing plant and others with newly constructed facilities which "reinforce" its existing network. These reinforcements will be subject to the difficult and costly real world build out conditions mentioned earlier.

E. *HATFIELD AND RLCAP CAPITAL COSTS*

Q. DOES THE HATFIELD MODEL USE ECONOMIC DEPRECIATION LIVES AND FORWARD-LOOKING COSTS OF CAPITAL?

A. Not in all cases. For example, the default values submitted in Hatfield 2.2.2, in the Colorado arbitration case proceeding use 20 year "economic lives" for distribution and feeder investments.[66] These lives are uneconomically long. U S WEST's cost studies use shorter, more appropriate depreciation lives, as explained by U S WEST witness William Easton in his testimony. Additionally, the default cost of capital submitted with Hatfield 2.2.2 in Colorado was 10.01 percent (the weighted average of debt and equity) in nominal terms, well below U S WEST's forward looking cost of capital.

Q. WHAT IS THE IMPACT ON THE AVERAGE MONTHLY LOOP COST ESTIMATE FROM THE HATFIELD MODEL WHEN IT IS RUN WITH ECONOMIC DEPRECIATION LIVES AND RISK-ADJUSTED COST OF CAPITAL?

A. Figure 3 presents the Hatfield Model results with U S WEST's economic depreciation lives and forward-looking cost of capital. Note that these Hatfield monthly loop cost estimates are slightly greater than U S WEST's TELRIC of $25.97. It seems that the inputs are the primary source of discrepancy between the two models and, once appropriate inputs are inserted into the Hatfield Model, the results are accurate. It should be pointed out the Hatfield Model may also underestimate the common costs incurred when providing local exchange service.

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[66] Hatfield Model Version 2.2 Release 2, Appendix C, Expense Module Inputs.

Figure 3

MONTHLY LOOP COSTS FOR COLORADO FROM THE HATFIELD MODEL

	Monthly Loop Cost	% of Monthly Loop Cost (per RLCAP)
Hatfield with adjustments as shown in Figure 2	$23.40	90%
Hatfield with U S WEST Economic Lives	$23.94	92%
Hatfield with U S WEST Cost of Capital and Economic Lives	$26.27	101%

F. U S WEST'S TELRIC COST STUDIES COMPLY WITH ECONOMIC PRINCIPLES AND THE FCC'S TELRIC COSTING METHODS

Q. WHAT ARE THE COSTING CONCEPTS THAT UNDERLIE U S WEST'S TELRIC MODELS?

A. U S WEST's cost models have evolved as U S WEST gains greater understanding of the underlying engineering economics as they apply to cost causality and the other concepts listed below. It is my understanding and expectation that these models will continue to evolve as U S WEST establishes and maintains consistency in the application of these basic concepts within their models during a period of accelerating change in telecommunications:

causality: models need to accurately attribute costs to the factors that cause those costs to be incurred; where necessary statistical analysis will be used to determine causality;

realism: realistic assumptions are needed for network engineering, installation, operations and maintenance, recognizing that field conditions often make the achievement of "theoretical optima" difficult or impossible;

entry costs: employ realistic assumptions about the costs an entrant into local exchange services would incur, which includes current market values for items such as equipment, land and buildings;

entry effects: employ realistic assumptions about the costs that would be incurred by an entrant in a competitive environment, including the costs of providing multiple interconnections with multiple entrants, lower plant utilization rates and higher marketing costs;

neutrality: do the best job possible with respect to the engineering assumptions, economic logic and analytical methods employed in the cost models, without respect to their effects on cost estimates.

Q. ARE U S WEST'S COST STUDIES AND UNBUNDLED NETWORK ELEMENT PRICES CONSISTENT WITH ECONOMICALLY CORRECT COSTING PRINCIPLES SUCH AS THE FCC'S TELRIC RULES?

A. Yes, U S WEST's cost models incorporate assumptions consistent with proper economic principles. These cost models, as described in the testimony of Garrett Y. Fleming, are based on forward-looking, total element costs, using the existing grid of network nodes, realistic fill factors, economic depreciation rates, a forward-looking, risk-adjusted cost of capital, and proper attribution on a cost-causal basis of indirect expenses to network elements.

Q. HAVE U S WEST'S MODELS BEEN AVAILABLE FOR SCRUTINY?

A. Yes. U S WEST's models, in their current form, have been available to new entrants and the Commission since the beginning of the arbitration proceedings. Further, any confidentiality restrictions that have been placed on the inputs to RLCAP are the result of stipulations placed on U S WEST by its vendors, not a desire by U S WEST to keep their models or inputs a secret.

Q. PLEASE EXPLAIN HOW U S WEST'S COST MODELS ARE BASED ON THE BEST AVAILABLE TECHNOLOGY AND THE EXISTING NETWORK ARCHITECTURE.

A. U S WEST's models employ "efficient network configuration" by estimating the costs which are incremental to providing elements using the best available technology, the most efficient mix of resources (land, labor, capital), and the existing grid of U S WEST's network nodes. The U S WEST models do not, on the other hand, make the unrealistic assumption that the landscape is a clean slate upon which all wire centers, switches, and other plant can be optimally located given the now-existing distribution of customers and demand. As the FCC Order recognizes, to do so would discourage economically efficient facilities based entry.

Q. DO U S WEST'S COST MODELS USE REALISTIC "FILL FACTORS" AND UTILIZATION RATES?

A. Yes, U S WEST's cost models use realistic assumptions about capacity utilization rates and fill factors. Well before the recent FCC Order, U S WEST recognized the importance of basing its forward-looking incremental cost estimates on realistic "fill factors" that properly attribute the cost of stand-by capacity to services that cause this cost. When deciding on how much feeder plant to deploy in a given area, for example, U S WEST weighs the cost of adding plant sooner rather than later, given the expected growth in demand for lines and the service quality benefits of stand-by capacity in maintenance and repair. Hence, the costs of stand-by capacity are part of the total element long run incremental cost of providing and maintaining unbundled loops; in terms of causality, their costs are not shared with any other services. As noted earlier, this type of realism is particularly important given that incumbent LECs are required to maintain stand-by capacity in order to fulfill state quality-of-service and ready-to-serve obligations and thus have lower capacity utilization than they would choose based purely on business considerations.

Q. DO U S WEST'S COST MODELS USE ECONOMIC DEPRECIATION RATES FOR CAPITAL RECOVERY?

A. Yes. U S WEST's cost models are consistent with sound economic logic, which requires the use of economic depreciation lives for calculating realistic forward-looking incremental costs. This ensures that U S WEST is afforded a reasonable opportunity to recover the full economic costs they incur when providing unbundled network elements. U S WEST is facing a changing environment, including rapid technological advances and impending full-scale local exchange entry by a variety of competitors. These changes are likely to shorten the depreciation lives of telecommunications facilities. Increasing competition also strips away regulatory safeguards that in the past protected U S WEST from the financial risks inherent in overstating the expected lives of its plant and equipment. The FCC Order and U S WEST's cost studies recognize the need for adopting depreciation rates that are based on realistic assessments of the economic lives given the environment facing U S WEST and all local exchange providers. The continuance of rapid change will necessitate frequent reassessment of these lives. U S WEST witness William Easton provides a more detailed explanation of the economic depreciation lives used by U S WEST in their cost models.

Q. DO U S WEST'S COST MODELS USE A FORWARD-LOOKING, RISK-ADJUSTED COST OF CAPITAL?

A. Yes. U S WEST uses a forward-looking, risk-adjusted cost of capital in its TELRIC studies. In calculating this capital cost, U S WEST assesses actual conditions prevailing in debt and equity markets, given the reality that increasing competition makes it infeasible for U S WEST to rely solely on its regulated rate of return to set the cost of capital for use in its TELRIC studies. The FCC Order, and this costing and pricing proceeding, demonstrate that U S WEST can no longer base its forward-looking cost of capital on the expectation of a continued rate of return environment. Looking forward, U S WEST is facing capital funding conditions that are more in line with a competitive future than with its regulated past. It is, therefore, necessary for U S WEST to consider information from capital markets that reflects this reality, such as information on the costs of capital for similarly situated firms, when estimating its forward-looking, risk-adjusted cost of capital. Unless the worst aspects of the FCC Order are overturned on appeal, the risks facing U S WEST will increase substantially, and so, it turn, will its cost of capital.

Q. DO YOU HAVE ANY FIRST HAND EXPERIENCE ESTIMATING THE MAGNITUDE OF FINANCIAL RISK FACED BY INCUMBENT LECS?

A. Yes. Earlier this year I participated in the construction of the LECG Financial Simulation Model (LECG Model) and co-authored a paper filed with the FCC that explains the results of this model. The LECG Model simulates revenues and operating incomes of the landline telephone operations of the large local exchange carriers (LECs) under current conditions and with a range of interconnection prices and policies. Key policy decisions analyzed in this model include the pricing of unbundled loops, local exchange resale, access bypass, the terms for competitors' purchase and rebundling of low priced unbundled elements, and the terms for interconnection. Changes in operating incomes for the landline telephone operations, the model is used to estimate the impacts of simulations on the total "firm" equity value of the composite of the large LECs. The model results indicate that the financial impacts of inappropriate prices and polices could be dramatic and make it impossible for the large LECs to sustain their investments in the national telecommunications infrastructure. A copy of this paper is attached as Exhibit II.

Q. DOES U S WEST FACE GREATER THAN AVERAGE EXPOSURE TO PRICES AND POLICIES THAT PLACE INCUMBENT LECS AT A COMPETITIVE DISADVANTAGE?

A. Yes. The LECG Model demonstrates that the composite of the eight large local exchange carriers is subject to significant financial harm if prices are not properly aligned with costs. Among the eight companies, the potential for significant losses for U S WEST throughout its region, is greater than average for two reasons. First of all, U S WEST faces higher than average costs due to lower than average access line density throughout most of its region. On average, U S WEST serves fewer than 50 access lines per square mile, which is the lowest access line density among the seven RBOCs and only one-seventh of the density served by Bell Atlantic. U S WEST could be faced with the obligation of continuing to incur high loop costs due to its carrier of last resort obligations, even if it is not fully compensated in the prices of network elements, particularly the loop. In order to cover costs, U S WEST would need to subsidize the elements it sells to competitors with revenues from its remaining end-users. Second, the rate structures in U S WEST states are rife with vulnerable subsidies. The rate structures are vulnerable because of large imbalances between prices and costs. A prime example is the fact that the price for basic business service in most U S WEST states is more than twice the price of residential service, even though the costs of providing business and residential services are similar in a given geographic area.